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EXAMINER	
STULTZ, JESSICA T	
ART UNIT	**PAPER NUMBER**
2873	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/523,122	SASAKI ET AL.	
	Examiner	Art Unit	
	Jessica T. Stultz	2873	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 September 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-10 and 12-27* is/are pending in the application.

4a) Of the above claim(s) *1-8,26 and 27* is/are withdrawn from consideration.

5)☒ Claim(s) *12,14 and 15* is/are allowed.

6)☒ Claim(s) *9,10,13 and 16-25* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *27 January 2007* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim 9 is rejected under 35 U.S.C. 102(b) as being anticipated by Kikuchi et al US 5,526,169, herein referred to as Kikuchi et al '169.

Regarding claim 9, Kikuchi et al '169 discloses an electro-optic modulation device that includes an electro-optic crystal having a birefringence index changed by a coupled electric field (Column 4, line 54-Column 6, line 39, wherein the electro-optic modulator comprises crystals "1" and "2", which change the polarization of a laser beam based on an applied electric field from signal "9" and thereby has a variable birefringence index, Figures 2-3), and one pair of electrodes disposed so as to have the electro-optic crystal interposed therebetween to couple the electric field to the electro-optic crystal (Column 5, line 26-Column 6, line 39, wherein the pair of electrodes comprise groove electrode "5" and electrode "3", which surround the crystal "1" as shown Figure 2), and that changes polarization of light incident between the one pair of electrodes according to a change of the birefringence index depending upon a strength of the electric field coupled via the one pair of electrodes (Column 4, line 54-Column 6, line 39, wherein the polarization of light incident upon face "b" changes based upon the electric field strength applied to the electrodes by signal source "9", Figures 2-3), the electro-optic modulation device comprising: a base portion having a top surface (Column 4, line 54-Column 6, line 39,

wherein the base portion is the lower portion of electro-optic crystal "1" comprising a top surface defined by the lower portion of grove "8", Figures 2-3); and a ridge portion projecting from the top surface and extending in a direction of the incident light, at least a part of the ridge portion comprising the electro-optic crystal (Column 4, line 54-Column 6, line 39, wherein the ridge portion is the elevated portions of the crystal "1", Figures 2-3), the ridge portion having a width equivalent to a predetermined value or less (Column 4, line 54-Column 6, line 39, wherein the ridge portion has a width defined by the length of face "c", Figures 2-3), wherein the electrodes are formed on one pair of side faces opposed in a width direction of the ridge portion and on the whole top surface adjacent to the side faces (Column 5, line 26-Column 6, line 39, wherein the electrodes "5" and "3" are formed along opposing sides of the crystal "1" in a width direction and cover the exposed top surface of the base portion defined by the groove "8" as shown in Figures 2-3), and a distance between the electrodes formed on the one pair of side faces and a length of the ridge portion in the direction of the incident light are defined so that light propagating in the ridge portion does not get out of the ridge portion (Column 4, line 54-Column 6, line 10, wherein a distance between the electrodes and a length of the ridge portion are defined, specifically as 0.4 mm and 12 mm, respectively, and Column 6, lines 11-19, wherein incident light propagates through the ridge from face "1b" of crystal "1" and out face "2b'" of crystal "2", Figures 2-3).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are

such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kikuchi et al '169 as applied to independent claim 9 above.

Regarding claim 25, Kikuchi et al '169 discloses an electro-optic device as shown above wherein the ridge portion comprises electro-optic crystal (Column 4, line 54-Column 6, line 39, wherein the ridge portion comprises electro-optic crystal "1", Figures 2-3), wherein the base portion is made of a en electro-optic crystal made of KTP (Column 4, line 54-Column 5, line 24), but does not specifically disclose that the base portion comprises photonic crystal having a periodic structure. However it is well known in art electro-optic crystals for periodic photonic crystals to be made of KTP for the purpose of forming electro-optic crystalline structures with non-linear properties. Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made for the electro-optic device of Kikuchi et al '169 to further comprise the base portion comprising a photonic crystal having a periodic structure since it is well known in art electro-optic crystals for periodic photonic crystals to be made of KTP for the purpose of forming electro-optic crystalline structures with non-linear properties.

Claims 10, 13, and 16-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kikuchi et al '169 as applied to independent claim 9 above, in view of Minakata et al US 4,866,406, herein referred to as Minakata et al '406.

Regarding claims 10 and 13, Kikuchi et al '169 discloses an electro-optic modulation device as shown above, but does not specifically disclose that the ridge portion is formed nearly in the center of one side face of the base portion when seen from the direction of the light

incidence, or that an insulator covers the ridge portion and parts of the electrodes, formed on one pair of the side faces. In the same field of endeavor of electro-optic modulation devices, Minakata et al '406 teaches of an electro-optic modulation device comprising a ridge portion formed nearly in the center of one side face of the base portion when seen from the direction of the light incidence (Column 8, lines 28-68, wherein the modulator shown in Figure 1 comprises a base portion "1" and a ridge portion "2" comprising an electro-optic crystal formed nearly in the center of the base from the light incidence side) wherein the ridge portion and parts of the electrodes, formed on one pair of the side faces are covered by an insulator (Column 8, lines 28-68, wherein the ridge portion "2" and internal sides, i.e. parts thereof, of electrodes "4" formed on side faces of ridge portion "2" are covered by an insulating silicon dioxide layer "3", Figure 1) for the purpose of providing an insulating layer having a smaller refractive index than the optical waveguide to laminate the device in order to reduce dielectric losses (Column 7, lines 57-65 and Column 8, lines 28-68). Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made for the electro-optic modulation device of Kikuchi et al '169 to further comprise a ridge portion formed nearly in the center on the one side face of the base portion when seen from the direction of the light incidence, wherein an insulator covers the ridge portion and parts of the electrodes, formed on one pair of the side faces since Minakata et al '406 teaches of an electro-optic modulation device comprising a ridge portion formed nearly in the center on the one side face of the base portion when seen from the direction of the light incidence, wherein the ridge portion and parts of the electrodes, formed on one pair of the side faces are covered by an insulator for the purpose of providing an insulating layer

having a smaller refractive index than the optical waveguide to laminate the device in order to reduce dielectric losses.

Regarding claims 16-20, Kikuchi et al '169 discloses an electro-optic modulation device as shown above, but does not specifically disclose that the device comprises a low refractive index medium having a refractive index which is lower than a refractive index of the electro-optic crystal, at least near a side face of the ridge potion located on the base side and included in one pair of side faces other than the one pair of side faces on which the pair of electrodes are formed, wherein an upper portion of the ridge portion comprises the electro-optic material and a lower portion of the ridge or base portion comprises the low refractive index material, wherein the low refractive index medium is electro-optic crystal of similar components to the electro-optical crystal, but which is lower in refractive index on the basis of a difference in composition ratio. In the same field of endeavor of electro-optic modulation devices, Minakata et al '406 teaches of an electro-optic modulation device comprising a ridge portion as shown above and further teaches that the device comprises a low refractive index medium having a refractive index which is lower than a refractive index of the electro-optic crystal at least near a side face of the ridge potion located on the base side and included in one pair of side faces other than the one pair of side faces on which the pair of electrodes are formed wherein an upper portion of the ridge portion comprises the electro-optic material and a lower portion of the ridge or base portion comprises the low refractive index material (Column 7, line 40-Column 8, line 68, wherein the substrate "1" comprises a material (LiNbO3) which has a lower refractive index than the material (Ti-diffused $LiNbO_3$) of optical waveguide crystal section "2", Figure 1), wherein the low refractive index medium is electro-optic crystal of similar components to the electro-optical

crystal, but which is lower in refractive index on the basis of a difference in composition ratio (Column 7, line 40-Column 8, line 68, wherein the substrate "1" is made of similar crystal material to the waveguide section "2" yet has a lower refractive index than the optical waveguide crystal section "2", Figure 1) for the purpose of providing an optical waveguide with small dielectric losses (Column 7, lines 57-65 and Column 8, lines 28-68). Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made for the electro-optic modulation device of Kikuchi et al '169 to further comprise a low refractive index medium having a refractive index which is lower than a refractive index of the electro-optic crystal, at least near a side face of the ridge potion located on the base side and included in one pair of side faces other than the one pair of side faces on which the pair of electrodes are formed, wherein an upper portion of the ridge portion comprises the electro-optic material and a lower portion of the ridge or base portion comprises the low refractive index material, wherein the low refractive index medium is electro-optic crystal of similar components to the electro-optical crystal, but which is lower in refractive index on the basis of a difference in composition ratio since Minakata et al '406 teaches of an electro-optic modulation device comprising a ridge portion as shown above and further teaches that the device comprises a low refractive index medium having a refractive index which is lower than a refractive index of the electro-optic crystal at least near a side face of the ridge potion located on the base side and included in one pair of side faces other than the one pair of side faces on which the pair of electrodes are formed wherein an upper portion of the ridge portion comprises the electro-optic material and a lower portion of the ridge or base portion comprises the low refractive index material, wherein the low refractive index medium is electro-optic crystal of similar components to the electro-optical

crystal, but which is lower in refractive index on the basis of a difference in composition ratio for the purpose of providing an optical waveguide with small dielectric losses.

Regarding claims 21-24, Kikuchi et al '169 discloses an electro-optic modulation device as shown above, but does not specifically disclose that the device comprises a low refractive index medium in an upper part of the base portion comprises a gas or that the device comprises an adhesive agent located as claimed. In the same field of endeavor of electro-optic modulation devices, Minakata et al '406 teaches of an electro-optic modulation device comprising low refractive index medium in an upper part of the base portion comprising a gas (Column 9, line 44-Column 10, line 35, wherein the gap "7" comprising air is the low refractive index medium in the upper part of the base portion, Figure 6) wherein the device comprises an adhesive agent located as claimed (Column 9, line 44-Column 10, line 35, wherein the adhesive agent comprises a buffer layer that acts as a laminate on an upper part of the base portion to bond the electrodes "4" to the substrate "1" as claimed, Figure 6) for the purpose of providing an optical waveguide comprising a buffer layer and an insulating layer with small dielectric losses (Column 7, lines 57-65 and Column 9, line 44-Column 10, line 35). Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made for the electro-optic modulation device of Kikuchi et al '169 to further comprises a low refractive index medium in an upper part of the base portion comprising a gas wherein the device comprises an adhesive agent located as claimed since Minakata et al '406 teaches of an electro-optic modulation device comprising low refractive index medium in an upper part of the base portion comprising a gas, wherein the device comprises an adhesive agent located as claimed for the purpose of providing an optical waveguide comprising a buffer layer an insulating layer with small dielectric losses.

Response to Arguments

Applicant's arguments filed September 25, 2007 have been fully considered but they are not persuasive. Specifically, regarding independent claim 9, as amended, applicant argues that Kikuchi et al '169 does not disclose that a distance between the electrodes formed on the one pair of side faces and a length of the ridge portion in the direction of the incident light are defined so that light propagating in the ridge portion does not get out of the ridge portion. However, the examiner disagrees since Kikuchi et al '169 discloses a distance between the electrodes formed on the one pair of side faces and a length of the ridge portion in the direction of the incident light are defined so that light propagating in the ridge portion does not get out of the ridge portion (Column 4, line 54-Column 6, line 10, wherein a distance between the electrodes and a length of the ridge portion are defined, specifically as 0.4 mm and 12 mm, respectively, and Column 6, lines 11-19, wherein incident light propagates through the ridge from face "1b" of crystal "1" and out face "2b'" of crystal "2", Figures 2-3) as shown above.

Regarding independent claim 13, as amended, applicant argues that the Minakata et al '406 reference does not disclose an insulator that covers the ridge portion and parts of the electrodes, formed on one pair of the side faces. However, the examiner disagrees since Minakata et al '406 teaches of the ridge portion and parts of the electrodes, formed on one pair of the side faces are covered by an insulator (Column 8, lines 28-68, wherein the ridge portion "2" and internal sides, i.e. parts thereof, of electrodes "4" formed on side faces of ridge portion "2" are covered by an insulating silicon dioxide layer "3", Figure 1) as shown above.

Allowable Subject Matter

Claims 12 and 14-15 are allowed.

The following is an examiner's statement of reasons for allowable subject matter: none of the prior art alone or in combination disclose or teach of the claimed combination of limitations to warrant a rejection under 35 USC 102 or 103.

Specifically regarding independent claim 12, none of the prior art alone or in combination disclose or teach of an electro-optic modulation device comprising a ridge portion comprising an electro-optic crystal as claimed, specifically comprising an insulator that covers the whole device.

Specifically regarding independent claim 14, none of the prior art alone or in combination disclose or teach of an electro-optic modulation device comprising a ridge portion comprising an electro-optic crystal as claimed, specifically comprising an insulator which covers a top surface of the ridge portion and side faces of a pair of electrodes which are continuous with the top surface of the ridge portion.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jessica T. Stultz whose telephone number is (571) 272-2339. The examiner can normally be reached on M-F 8-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ricky Mack can be reached on 571-272-2333. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Jessica T Stultz
Examiner
Art Unit 2873
November 13, 2007